

Present Claims

1. (Currently Amended) A handler for applying a vacuum holding force to an object, the handler comprising:

a body for applying a vacuum holding force having a plurality of levels of openings including a holding surface level and a suction surface level, wherein the diameter of the openings at the suction surface level are larger than the diameter of the openings at the holding surface level, and further wherein the openings at the suction surface level are in fluid communication with at least a portion of the openings at the holding surface level;

at least one intermediate level between the holding surface level and the suction surface level, wherein the diameter of the openings of the intermediate level are larger than the diameter of the openings at the holding surface level and smaller than the diameter of the openings at the suction surface level, whereby n levels are provided including the sum of the total number of levels including the holding level, the surface level and the intermediate levels,

wherein the openings at the holding surface level create a periodic pattern which is characterized by a frequency which is greater than the frequency of the periodic pattern of openings at the suction surface level;

wherein each level has a characteristic thickness defining a length, such that the length of the openings on the holding surface level are smaller than the length of the openings at the intermediate level, and the length of the openings on the intermediate level are smaller than the length of the openings on the suction surface level of the openings therein t_n , and a period p_n , wherein are substantially equivalent to each other

and

a vacuum source attached to said body at the suction surface level.

2-5. (Canceled)

6. (Previously Presented) The handler as in claim 1, wherein at least a portion of the openings at the suction surface level that are in fluid communication with at least a portion of the openings at the intermediate level are in direct fluid communication by alignment of the openings, and at least a portion of the openings at the intermediate level that are in fluid communication with at least a portion of the openings at the holding surface level are in direct fluid communication by alignment of the openings,

further comprising interconnecting openings for interconnecting openings at the intermediate level and at the holding surface level that are not in direct fluid communication by alignment of the openings.

7. (Original) The handler as in claim 1, further comprising at least one micro-mechanical valve in at least one of the openings.

8. (Previously Presented) The handler as in claim 1 wherein said body is formed of a material selected from the group consisting of metals, alloys, semiconductor materials, and ceramics.

9. (Previously Presented) The handler as in claim 1 wherein said body is formed of a semiconductor material selected from the group consisting of silicon, III-V type semiconductors, II-IV type semiconductors, II-VI type semiconductors, IV-VI type semiconductors, Ge, C, Si-oxide, and Si-nitride.

10-15. (Canceled)

16. (Currently Amended) A handler for applying a vacuum holding force to an object comprises:

a handler body having a plurality of levels, each level characterized by a thickness, and a vacuum source attached to said handler body, said handler body for applying a vacuum holding force ~~having a thickness~~,

a holding surface at ~~one~~ a first level having a plurality of holes for imparting vacuum force to an object, and

a vacuum surface at ~~another~~ a third level having at least one hole for a vacuum source,

~~the holding surface holes having diameters suitable for holding fragile objects utilizing a vacuum holding force, wherein vacuum paths are formed from the plurality of holding surface holes to the at least one vacuum surface hole, the vacuum paths configured, positioned and dimensioned to reduce resistance of gas flowing through the vacuum paths;~~

at least one ~~intermediate~~ second level between the ~~holding surface~~ first level and the ~~suction surface~~ second level, wherein the diameter of the openings of the intermediate level second are larger than the diameter of the openings at the holding surface first level and smaller than the diameter of the openings at the suction surface third level, whereby n levels are provided including the sum of the total number of levels including the holding level, the surface level and the intermediate levels;

the holding surface holes having diameters suitable for holding fragile objects utilizing a vacuum holding force, wherein vacuum paths are formed from the plurality of holding surface holes to the at least one vacuum surface hole, the vacuum paths

configured, positioned and dimensioned to reduce resistance of gas flowing through the vacuum paths; and

wherein a first thickness associated with the first level defines a hole length of holes on the first level, a second thickness associated with the second level defines a hole length of holes on the second level, and a third thickness associated with the third level defines a hole length of holes on the third level,

wherein the first thickness less than the second thickness, and the second thickness is less than the third thickness.

~~wherein the openings at the holding surface level create a periodic pattern which is characterized by a frequency which is greater than the frequency of the periodic pattern of openings at the suction surface level, wherein each level has a characteristic thickness defining a length of the openings therein t_n , and a period p_n , wherein are substantially equivalent to each other.~~

17. (Original) The handler as in claim 16, wherein the ratio of the handler body thickness to holding surface hole diameter is about 10^7 to about 10^2 .

18. (Original) The handler as in claim 16, wherein the ratio of the handler body thickness to holding surface hole diameter is about 10^6 to about 10^3 .

19. (Original) The handler as in claim 16, wherein the ratio of the handler body thickness to holding surface hole diameter is about 10^5 to about 10^4 .

20. (Previously Presented) The handler as in claim 7, further comprising a plurality of micro-valves attached to said holes at the suction surface level, the plurality of micro-valves are hingedly attached to the holes.

21. (Previously Presented) The handler as in claim 16, further comprising a plurality of micro-valves attached to said holes at the suction surface level, the plurality of micro-valves are hingedly attached to the holes.